

SENIOR DESIGN 405

Requirements Capture

Robotic Development Boards

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Introduction:

- **Standing Wheelchair Project**
 - The standing wheelchair will enable disabled persons the mobility of a wheelchair with the added benefit of being supported in a standing position. We need to develop motor controls to drive 2 brushless motors, 4 linear actuators and 2 servo motors. The controls will allow the user to choose direction of movement, adjust the position (sitting or standing) of the wheelchair and operate the safety arm that holds the person in place. These will all be controlled with a single joystick.
- **Autonomous Snow Plow Project**
 - We need to develop a motor controller to drive 2 brushed dc motors (used to drive the snowplow) as well as 1 linear actuator (used to control the pitch of the blade) and a winch to control the yaw of the blade.
- **Motorized Test Bed Cart**
 - To be able to test our design we want to put together a test cart. This project consists of a cart with multiple I/O devices such as motors and actuators for the projects above as well as future projects. It can be controlled by a programmed routine running on a microcontroller. The design and assembly of the cart has already been completed.

Requirements:

Control Board (Microprocessor, dedicated power rail, expansion slots for driver boards)

- Have the ability to be implemented into multiple projects as a development board
- Onboard microcontroller for sensor control and motor control)
- Input/output terminals must be designed for quick connection and release
- Discrete PWM ports
- Motor feedback ports
- Control board must fit within current project hardware setup
 - No larger than current setup
- Discrete power rails for microcontroller and associated hardware

Wheelchair Control Board

- Accept user input by joystick
- Controls linear actuators to stand occupant up
- Control rotational actuators to operate safety bars
- Included safety lock to prevent safety bars from opening up while in standing position

Driver Boards (Daughter Boards to the Control Board)

- Must be mountable on current mechanical fixtures
- PCB must be designed in such a way to handle high current loads

- It will be able to be implemented into multiple projects as daughter boards to the Control Board.
- Must work with different voltage supplies (12v – 24v)
- Isolation from low voltage electrically and physically
- PWM input to driver circuit
- Must be able to drive a DC brushed motor
 - Run in Torque Mode
 - Functions contain forward and reverse
- Must be able to drive 12V linear actuators
 - Can obtain one of two physically set positions
- Must be able to drive rotational actuators
 - Functions contain forward and reverse

Summary:

We plan to make one large project which will meet the requirements of the other three. The project includes the design and implementation of a driver and control board. The driver board will receive instructions from the control board, amplify the signals and pass them to the motors. The controller board consists of a microprocessor and circuitry allowing for a multitude of inputs with outputs designed to connect to the driver board. The microprocessor will have the ability to gather data from a variety of sensors. It will use these inputs to determine how the motors will be controlled. While developing the development board (driver and controller board combination) we will put together a test bed prototype cart which can be used to test our designs and show off our abilities. The goal is to build a universal, easily implemented control and driver board that can be used for multiple applications/projects.

This document describes all project requirements set forth by the advisor and/or client. Grading will be performed at the end of the semester according to the level at which these requirements are met.